

The CHICAGO NATURALIST



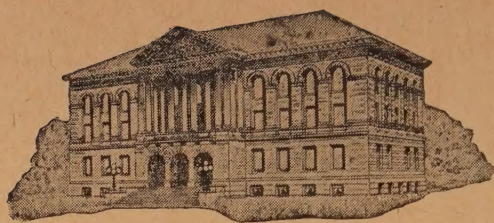
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NOVA PLANTARVM ANIMALIVM ET MINERALIVM MEXICANORVM HISTORIA

A FRANCISCO HERNANDEZ MEDICO

In Indijs præstantissimo primum compilata,

DEIN A NARDO ANTONIO RECCHO IN VOLUMEN DIGESTA,

A IO. TERENCE, IO. FABRO, ET FABIO COLUMNA LYNCEI
Notis, & additionibus longe doctissimis illustrata.

Cui demum accessere

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Theatri Naturalis Phytosophicæ Tabulæ

*Vna cum quamplurimis Iconibus, ad octingentas, quibus singula
contemplanda graphice exhibentur.*



ROMÆ MDCLI.

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Aztec Botany and Zoology

M. MALDONADO-KOERDELL*

Several civilizations or cultural complexes, as archaeologists delight in calling them, succeeded each other during pre-hispanic days in Ancient Mexico. Boundaries of Ancient Mexico were not coincident with those of the modern nation known under that name, and it may be safely assumed that the Tropic of Cancer to the north and the Isthmus of Panama to the south marked its limits. On both sides there was a sea, the Gulf of Mexico and the Caribbean Sea to the east and the Pacific Ocean to the west. Thus, Ancient Mexico very appropriately was called by Aztec Indians—who had a peculiar cleverness for names—Anahuac or "between waters."

From the remotest pre-historic times to the beginning of the Spanish conquest in the sixteenth century, an event that stopped the natural development of aboriginal cultures, five major civilizations succeeded each other within the territory of Anahuac. Pre-Archaic, Archaic, Olmec, Toltec-Maya and Aztec civilizations, along with other minor or subsidiary ones like Huastec, Tarascan, Zapotec-Mixtec, each constituted cultural complexes, at times intermingling freely in successive chronological stages in the order mentioned. Of all these civilizations, the Aztec, covering some two hundred years from the beginning of the fourteenth century to 1521, the year of the fall of the city of Mexico-Tenochtitlan into the hands of Cortes and his small army, is by far the best known and probably the best integrated and progressive.

The Aztec civilization marked also the culmination of aboriginal progressive tendencies because, as some writers have pointed out, with or without the Spanish conquest, major changes and a complete alteration of the social order arrived at in Ancient Mexico were imminent. The arrival of the Spaniards came to accelerate the process—in a bloody and violent way, it is true—but also brought many other good things and provided the foundation of a modern nation, Mexico.

In order to understand what is to be said of the botanical and zoological ideas of Ancient Mexicans, it seems desirable to express some considerations on their cultural traits before the coming of white men. Many an article has been published on this subject but a substantial evaluation of the Ancient Mexicans' knowledge of plants and animals is a thing that only a few are qualified to attempt. Familiarity with Mexican archaeology, ancient public and private life in Anahuac, knowledge of the religious dynamics of the different tribes that occupied its territory, and *first hand understanding of native writing and language* are qualifications seldom united in one man. However, two contributions,

*Latin-American (Mexico) Guggenheim Fellow, 1944-1946.

one on the botanical lore of the Aztecs by Don Francisco del Paso y Troncoso, the late Director of the National Museum of Mexico, and another on animal representations in Mexican and Mayan manuscripts by the German archaeologist and naturalist E. Seler, must of necessity be consulted by whomever becomes interested in the subject.

Aztec life was pervaded in every moment with the influence of deific powers, whereby a satisfactory explanation of the natural phenomena was sought by those Indians. On the other hand, there was a curious contrast between the essentially mystic inclinations of the aboriginal mind, and the exercise of an esthetic sense by the creation of many beautiful and useful objects in daily life.

Like all human beings, Aztecs made great efforts to know and understand their world and how best to use it, but their empirical, fatalistic tendencies, aided by an imaginative and artistic vein, account "for the paucity and character of their purely intellectual attainments," as Hewett says in his excellent book "Ancient Life in Mexico and Central America." As a result of these circumstances industrial life (and consequently, creative endeavors to exploit nature as a result of a better knowledge of natural phenomena) remained elementary and non-progressive.

Plants were for Ancient Mexicans things of spiritual pleasure and many applications but animals had quite a different meaning for them. They were imagined to be in possession of supernatural forces, or thought of as the incarnation of several deities and mythical beings, as shown in many zoö-morphic representations in monuments and manuscripts. However, in many cases the presence of botanical and zoölogical designs is purely ornamental in character, but of great importance for the estimation of the aboriginal attitude towards nature. This supernatural interpretation of animal life, with their more realistic ideas on plants, did not impede Aztec Indians from accomplishing a thorough study of their territory, flora and fauna. Anyone that sees a page in a "Matricula de Tributos," or tax-collector's guides, can not help to wonder how many of their spiritualistic ideas were slowly being supplanted by a semi-scientific knowledge of plants and animals.

Out of a world of color and line, of a social order sternly controlled by an authoritative roster of warrior-like priests and priest-like warriors, no really scientific interpretation of nature could evolve. Science (astronomy, botany, medicine), if there ever was such a thing in Anahuac, is to be considered merely as a cultural process, extending through countless generations, and being gradually reduced to schematic statements. Furthermore, the lack of written words, in a modern and useful sense*

*Writing among Aztec Indians was in part pictographic and in part hieroglyphic, and never reached the stage of a connected narrative, as Spinden says in his "Ancient Civilizations in Mexico and Central America."

was a tremendous impediment for the accumulation, conservation and transmission of a system of scientific ideas. However, as will be seen later on, nomenclature was satisfactory because, as Troncoso says, the Aztec language was admirably adapted for that role and remains today, with hieroglyphs and old paintings, the sole means to obtain an inside view of the scientific attitude of Ancient Mexicans.

Troncoso based his analysis of the botanical knowledge of Aztec Indians on its linguistic and pictographic characters, and tried to work out its main lines in regard to the morphology, physiology, iconography, taxonomy and practical applications of plants, as they were understood or practised in Ancient Mexico. Unfortunately, Troncoso's work was never completed and only a half of the whole article was published in the "Anales del Museo Nacional," in 1886. The Mexican archaeologist used many documents left by Indian herbalists and medicine-men, and very especially the works of Francisco Hernandez, First Physician to the King of Spain, Philip the Second, who was sent to Mexico in 1570 to study its natural productions. Incidentally, Hernandez' trip to this continent was the first scientific expedition ever organized for a systematic investigation of the territory, flora and fauna of any country. Thus, the honor of having started this sort of activity very distinctly belongs to the Spanish Crown, a fact not even mentioned in the great majority of textbooks on the history of biology and related sciences.

Hernandez, who came to Mexico only fifty years after the Spanish conquest, had the opportunity of visiting the old "gardens" of Texcoco, Oaxtepec and Tenochtitlan, and of talking with the remaining plant sages and herbalists. He learned many of their secrets and ideas on plants which he incorporated afterwards in his monumental work published in Rome in 1651. There is a second edition, also in Latin, of the botanical part of the book, that came out in Madrid in three volumes without plates in 1790. Abundant references to Hernandez' works, as is well known, are found in the literature although more modern standard books and publications have begun to supplant his fundamental contribution to the knowledge of Mexican natural history.

Ancient Mexicans had no word to designate the whole body of botanical ideas that they possessed. Their plant lore was derived primarily from practical sources and in a way formed a systematic account of the plant kingdom. Troncoso seems to be right in considering their knowledge of plants as based on a long and profound observation of nature, initiated during their early migrations, and maintained through generations until they were settled as agricultural people. This knowledge was increased afterwards until it began to form a sort of foundation that was to give way in due time to a more precise interpretation of plants.

A distinction between trees, shrubs and herbs was arrived at by Aztec Indians, as shown by the words *quahuil* (tree), *quaquaubtzin* (shrub),

and *xibuitl* (herb). Parts of plants had also their own names, rigidly applied in every case, and allowing no confusion: *nelhuayotl* (root), *quabuitl* (stem), *quaubxibuitl* (branch), *quaubhatlapalli* (leaf), *xochitl* (flower), and *xuchiquilli* (fruit). Different types of roots were distinguished, as indicated by several words: *camotli* (tuberous root), *xicama* (globular-tuberous root), and *xo-nacatl* (bulbar root). In the stem, the aerial portion was called *quabuitl* (woody or arboreal part) and the subterranean portion, *cimatl*. Ramification of branches, if direct, was called *quaubxibuitl* (tree-herb), and if indirect, *i-mama-in-quabuitl* (tree-hands). Ecological conditions were expressed by a combination of prefix and noun, the whole word sometimes being equivalent to a complete name for the plant, as in the case of water plants which were called *atl-i-nan* (plants growing in the border of rivers or lakes), from *atl* (water) and *i-nan* (mother); *atoyaxocotl* (Genus *Spondias*, Hernandez 2:500), derived from *atoyatl* (river) and *xocotl* (rapid), and many others.

Leaves, which are the brilliant parts of plants, were called in different ways, but always by terms which conveyed some idea of colored surfaces. The name *matl* was applied to younger leaves, or to those growing in individual stems, and the same was true with the word *izhuatl*; but *atlapalli* and *amatlapalli* indicated colored leaves. Simple and compound leaves were termed in such a way as to indicate the number of nervatures in the leaf; namely, *macuil-y-ma*, from *macuil* (five) and the root *ama*, indicating a line, or nervature. Anatomical details, like form, position, and others, had also their particular names, always combining a prefix and a noun.

Synonymy was abundant and included regional and technical names. This situation led Troncoso to imagine that the Aztecs were arriving, or had already arrived, at some system of classification. Actually it only indicates the practical side of the mentality of the Indians, who had built a very useful catalogue of morphological characters and properties of plants. Names, of course, varied from place to place and also according to the particular circumstance in which they were used or applied to plants. Thus, *chapolxochitl*, from *chapollin* (an insect of the genus *Sphenarium*) and *xochitl* (flower) and *tenapalatl* (house leek) were synonymous, and expressed certain peculiarities of form. A thorough study of the vernacular nomenclature and synonymy is one of the many problems still untouched in Aztec botany for practical purposes, and which ought to be studied further in the light of new linguistic knowledge. Hernandez' books and the recently published "Badianus Manuscript," as well as many other old documents, are treasures which have only been superficially scratched for this aim.

Graphic representations of plants were the main descriptive resource because nomenclature was insufficient in a way. Aztec writing had a triple

meaning: figurative, symbolical and syllabic, or was a combination of two or all three. If figurative, the plant name was truly a picture of the plant, as seen by the delicate details of leaves, branches and other parts in some of the plates of the "Badianus Manuscript." If symbolical, like the botanical figures in many "Matriculas de Tributos," the sign had a determinant, as shown in the figure of a pine in the "Mendocino Codex" (41:8, Kingsborough). If the name was written in the syllabic form, it was a combination of several hieroglyphs, indicating each a portion of the whole word, namely, the word *Hoaxin* (Genus *Cassia*), from *Hoax-tepec* or *Oaxtepec*, where the famous "Garden" of Montezuma was located, and the root for place.

Applications of medical and industrial nature were multiple, and many of them are still practised in Mexico. Cortes himself was a great admirer of the abilities of Indian medicine-men, and paid them a high tribute when he asked in his second letter to the Spanish Emperor that no European physicians be allowed to come to this continent, because they could not match the accomplishments of native physicians. Primarily botanical knowledge of the Aztecs was derived from the empirical use of plants as remedies in many diseases. Herbalists are still seen in Mexican markets where they hold a highly respected position. If properly approached, these herbalists could be turned into good informants on native plant lore which they inherit and conserve jealously as a family secret.

Of the industrial applications of plants there are many examples; for instance, in the agave group that yielded so many products; paper, fibers, needles, roof-covering and many articles manufactured by Aztec Indians of past and present times. Different kinds of "cotton" plants were cultivated in Ancient Mexico, and hundreds of thousands of blankets were paid as tributes, as shown in the "Matriculas de Tributos," to say nothing of the "cacao" plant, used as money by the Aztecs.

If plants were articles of daily use and in many ways a foundation of the economic life of Ancient Mexicans, animals, in spite of the fear that they inspired, were also kept for practical applications. For example, feather-work was an honorable type of profession, in the hands of *amanteca*, a sort of nobiliary order of feather-workers. However, these realistic uses of animals contrasted with the transcendent interpretation of their nature. Aboriginal religious dynamics was essentially totemic in character, since animals played an important role, a mixture of strange ideas and representations. Zoöomorphic figures clearly show that animals had a totemic significance, and that through the study of these figures an insight into the zoölogical ideas of Aztec Indians can be obtained. The German archaeologist and naturalist Seler, in a dissertation on "Animal Representations in Mexican and Mayan Manuscripts," in Volume 4 of his *Gesammelte Abhandlungen*, had studied in the light of modern

zoölogy animal hieroglyphs and paintings, and explained the ideological value of their attributes and their totemic meanings.

The monkey was a representative of pleasure and distraction and was associated with singing and dancing. It represented also the mental tricks that long since have masked many physical and moral problems; namely, the sexual sin. By its aspect, agility and volubility, the monkey was thought of as the living representative of the wind, whose hieroglyph was merely the conventionalized face of a monkey, *ehecatli* or *ecatli* (wind). Furthermore, the same animal served to symbolize one of the days in the calendaric manuscripts. Incidentally, the monkey that was usually represented in hieroglyphs and paintings was called *ozomatli* (*Ateles vellerosus* Gray) and one of its most important characteristics was the joyous and sinful attitude, congenial with the common idea that people had of the monkey.

The dumb dog, called *itzcuintli* or *chichi* (*Canis caribeus* Linnaeus) was another exceedingly well known animal to Ancient Mexicans, one of the very few that ever became domestic. Its hieroglyph was also used to represent one of the days of the month, in the form of a dead man, or a falling god in a cemetery. This hieroglyph is commonly found in manuscripts, decorated in various colors and with different attributes. Mexican dumb dogs, as described by Sahagun and Hernandez, became totally extinct shortly after the Spanish conquest.

The rabbit or *tochtli* and the hare or *citli* had a prominent participation in fables and tales in Ancient Mexico. Aztec Indians thought that a rabbit, and not a man, as in the common occidental fable, was sitting on the moon. Colors and attributes of the rabbit in pictures were peculiar, always painted in a yellow color, or in a black-spotted clear tone. The ears were long, the eyes rounded, and the incisors (of the upper jaw) very protruding. The rabbit was also a representative of one of the days in the religious month.

Other mammals were also studied by Seler in their representations and symbols as a basis for their taxonomic identification. In general terms it is easy to arrive at least to the generic category in the case of many animals, since artists were careful in representing exactly the kind of animal that they were painting, and tried to avoid any mistake leading to an offense in the mind of the god-animal.

Among birds the quetzal (*Pharomachrus mocino mocino* de la Llave) was most famous, its beauty having attracted the attention of Aztecs from the remotest times. It is commonly found in monuments and manuscripts, always pointing to a cardinal direction (meaning richnesses and abundance). The quetzal was also a symbol of gaiety and adornment, and with its feathers the *amanteca* made beautiful ceremonial cloaks, as well as garments for warriors. The humming bird or *huitzitzilin* corresponded to rainy seasons, as Aztecs thought, and disappeared during the

rest of the year, symbolizing the renaissance of life in springtime. Eagles were very important in Aztec mythology, and represented also one of the days in the religious month. The same birds were also used to represent courageous warriors, along with the jaguar or *ocelotl*, and both became attributes of two military orders. The *zopilotl* (*Coragyps atratus* Bechstein) or common buzzard, was well known to Ancient Mexicans, as well as owls, which were considered as representatives of the night powers, and always seen in a frontal position, sometimes accompanied by a skull, meaning obscurity and death.

Reptiles were the most impressive animals in Ancient Mexico, as shown by the snake cult, so strongly rooted in all aboriginal religions. Snakes were constantly painted, either in a realistic way or adorned with all sorts of attributes, like feathers, claws, and teeth. If the human figure, as Spinden says, was generally accepted as an adornment, and used accordingly in monuments and manuscripts, the naturalness of the representation was altered by the mixture of grotesque zoömorphie details, and relegated to a secondary place in ornamental design, made up of animal symbols, mainly snakes. Very frequently human-faced snakes with complete bodies were carved in stone and placed in front of the entrances to temples, as in the well-known Tenayuca pyramid near Mexico City, one of the most astounding combinations of a temple and an observatory, that is conserved practically intact.

Crocodiles and alligators were thought of as fabulous beings, associated with lightning, and their hieroglyphs were as conventional as those of snakes, with a mixture of diverse attributes. Frogs and toads, and in a lesser way fishes, were also symbols of varied nature, though less rich in details. The name of the larva of a Mexican salamander *Siredon mexicanum* (Shaw), or *axolotl* has become a part of the scientific jargon in many languages, and meant originally a *water devil*, or ugly animal.

Other animals were also used to symbolize deities or supernatural entities and, in each case, color and form were as important as the god itself. But, notwithstanding their totemic interpretations of animals, Aztec Indians also knew well how to take advantage of the more productive forms, as shown by their uses of the cochineal bug, a peculiar kind of honey-bee, and many others described carefully by Baron von Humboldt in his "Political Essay on the Kingdom of New Spain." In summary, among the many cultural traits of Aztec civilization was the religious interpretation given to animal forms, derived from totemic practises, that allowed a certain familiarity and even some knowledge of their morphology and life habits. As in the case of plants, in due course, the totemic character of this elementary zoölogical knowledge was to be superseded by a more logical or scientific interpretation of the true nature of animals.

Watching a Carolina Wren's Nest

AMELIA R. LASKEY*

Today, July 10, I shall watch the Carolina wrens that have built in a nest box at the edge of the woods just off Highway 100 in Percy Warner Park. On June 25, the nest was complete except for lining. It is built mainly of green moss, leaves, and leaf skeletons and is the typical kind of this species, with a roof and side entrance. The first of the five eggs was laid on June 30; the female was incubating when the nest was last visited July 7.

It is a little after nine-thirty of a hot, humid morning after a heavy shower last night. I find an inconspicuous spot some twenty feet from the box, where I set my little three-step ladder as a seat under the drooping boughs of an Osage orange (hedge apple) and a peach, the latter laden with green fruit. I wonder if a squirrel or some picnicker inadvertently planted the peach seed. At my feet, is a jewel weed with its first blossom, a clear yellow. Behind me are more jewel weed with blossoms farther advanced, and tall spikes of lavender-pink blossoms with the square stems of the mint family which I believe are scutellaria or skull-cap. Raspberry canes that have given up their crop border the woods, and blackberries, with other growth, are behind them. These are fruiting now. Before me, scattered in the weedy open space between the woods and a clump of trees between me and the highway, are many plants that have sprung up in the blue grass. Nearest and most conspicuous, are the tall teasle, now displaying beautiful soft bands of tiny orchid-colored flowers on the green seed heads. These are meccas for butterflies; I see a swallowtail, a fritillary, a sulphur and a swarm of silver-spotted skippers (according to my butterfly guide). Each teasle plant harbors from one to seven of the latter. It seems to be a great day for them for I find numbers elsewhere.

This watch period promises to be far more interesting than the monotonous time I spent at home last month watching our mail box when the Bewick's wrens had their nest there. Here is privacy with only the woodland creatures about me, and no passing neighbors and strangers to wonder audibly or inaudibly what in the world I was doing, or stopping to chat, thus causing me to miss the little wren as she slipped quietly in or out, and losing much of the time I had spent, necessitating a fresh start on the incubation rhythm observations. Life is buzzing all about me. Birds are singing and calling. A yellow-breasted chat resents my presence and directs all its attention to me, gradually encircling the area several times as it flies from tree to tree or bush, keeping its bright eyes

*Graybar Lane, Nashville, Tennessee.

upon me and uttering its various warning or alarm notes—a strident *zee ou*, with the accent on the last syllable, and a sharp *zick, tcb*, or *tuck*, which I can imitate fairly well by a sharp smack of the tongue against the roof of mouth, or perhaps by hitting two pebbles together. Whatever activity the chat had been engaged in at my arrival was neglected for nearly two hours as it deliberately moved to view me from all angles. The warning notes gradually decreased until they were scarcely audible and the wing beats sounded louder than the vocal notes.

Closer to me came insects of many varieties. One could not venture to watch all this teeming life, interesting as it was, for eyes must not be diverted even for a minute from the box which was the big question mark at this point. Whether the little Carolina was on her eggs or not, or whether there were still eggs, I did not know. If the bird is incubating, I must not disturb her, or if she is out foraging, that will soon be evident. Yet, had I known how long this initial vigil would prove to be, investigation would have been made immediately. But I must wait, so, while the various insects flew or crawled about, I practiced side glances to see what I could, and still concentrate on the wrens. A June bug zoomed past on its way to the peaches, a fly persistently landed on my hand to crawl about. It acted like one of the parasitic flies and remained to be killed by a slap of the other hand. Wasps had to be brushed off. Once something landed on my collar to crawl to my neck. Without thinking, up went my hand to brush it off, but *wow!* a painful sting on a finger cushion sent pains into my hand and arm. I have been pulling *Polistes* out of the Warner Park bird boxes these ten years without a sting because I moved faster than they, but this one had the advantage of me.

All this time, there was a chorus of birds singing in the trees and woods about me. I did not dare look for them but at times could hear three white-eyed vireos singing at once, two yellow-billed cuckoos, and several indigo buntings. During the morning, I counted almost twenty species that I could identify from their calls and songs, besides a few others that I could not place. There were at least three chats, two chickadees, summer tanager, Kentucky warbler, wood thrush, red-eyed towhee, goldfinch, cardinal, red-eyed vireo, hooded warbler, blue-gray gnatcatcher, chimney swifts, blue jay, hummingbird, catbird. These are not in A. O. U. Checklist order, but that is the way they reached my ears and their names scribbled on my note book. The hummingbird whizzed past the nest box as I dutifully looked at it, but I could not quite trust my eyes in that one-second view of it among the insects and butterflies all about me. But before I left, it came to me. First I heard the hum in the peach tree above, then it came down to pause at the blossoms of the jewel weed,

hesitating within a yard of me. I held my breath, thinking it was coming to the jewel flower beside me, but no—he moved on—his lovely ruby gorget shining in the sun. He has me ahead of my story, for his final visit was something of a climax just before I left.

Nearly three and a half hours I sat with my eyes almost glued to that box, trying to relax a bit by using one eye at a time, and other devices to relieve the tension. At times, I was wet with perspiration, then a small breeze came out of nowhere to stir the leaves gently and refresh the watcher. For the first 85 minutes, I knew nothing of what was happening in that box. Then the little gad-about came home. She apparently caught a glimpse of me among the greenery, although I was garbed in inconspicuous clothing and wore a dark, brimmed hat to shade my face. She rasped for over five minutes before going into her nest. The hot sun had been shining on the box all morning so the eggs must have been warm. She remained on them only fifteen minutes when a song from the male was heard in the woods to the east. A rasping call sounded from inside the box and out came her head, then she flew east, apparently to join her spouse in another round of visits in the woods. This time, she returned in 41 minutes by my pocket Ben. She had apparently forgotten all about me for she dashed into the box without a sound. It was now noon for me, according to the "daylight-saving-time" we are living by at this season, so I was beginning to think about the little lunch that was in my car down by the side of the road. But, judging by her other period on the nest, I decided that I must wait until the end of this one, for, surely in the heat of this mid-summer day, she would stay on only 15 or 20 minutes. Just then one of the towhees began to sing. There are many varieties of towhee songs but this was one of those "*drink your tea*" fellows. What a time to remind me of lunch! I listened closely for the song of a Carolina wren. Maybe he would call the woman off again for a tidbit, but no luck. She sat and sat. I watched and watched. Towhee gave up at 12:30 and probably went for his own lunch. I began to wonder if one of the many diversions had not tempted my eyes away long enough to let the little wren slip off to the woods unseen. Finally, I promised myself that I would wait until 1:00 P. M. and then must investigate to see if she had fooled me. At two minutes to one, watch in hand, I began to ease over to the box and, at exactly 1:00 P. M., raised the box top. Mrs. Wren shot out like a flash into the woods. There she must have met her mate, waiting more patiently than I for her to leave. A musical note was sounded, then a rasping note, then a song. And I went to lunch—melted cheese sandwiches, melted by Old Sol who had made the locked car as hot as an oven. But what a lovely morning and what a perverse human-like little wren that would gad all morning and then sit so patiently all through my

lunch hour. Tomorrow I hope to see how she spends her afternoons.

* * *

For the benefit of readers desiring more specific information on the behavior of the wren while being watched during these periods, I submit the following statistical summary.

The nest of a Carolina wren (*Thryothorus ludovicianus*) was found June 25, 1946, when almost complete, in Percy Warner Park, near Nashville, Tennessee, in a bluebird-type box, set on a post in an open space. Woods and thickets bound three sides of the meadow, with the highway on the west. Immediately behind the box is a clump of trees which shade it from the afternoon sun. Much green moss was used with the dry leaves, leaf skeletons, stems and grass that compose the bulk of the nest. The first of 5 eggs was laid June 30, incubation apparently beginning with the laying of the last egg, July 4.

On July 10, I watched from 9:41 A. M. to 1:00 P. M. (C.D.T.) She spent 73 minutes (37 per cent) on the nest and 126 minutes (63 per cent) off. The box was exposed to sunshine. (U. S. Weather Bureau reports temperatures of 75°-93° F. for the 24 hour period.) The nest incubation rhythm follows: off +85, on 15, off 41, on 58+ minutes.

On the following afternoon (official 24 hour temperatures 72°-94°) observations were made from 1:15 to 4:10 P. M. In the heat of that afternoon, with the box in shade, she was on 87 minutes and off 88 (50 per cent). The periods were as follows: off +28, on 87, off 60+ minutes. (The plus sign indicates periods that had already started when my observations began or were not finished when watching was discontinued.)

Two nestlings were hatched by 7:40 A. M. on July 18; at 7:00 P. M. there were 4 young and one egg. This indicates an incubation period of 14 to 14.5 days after laying of the last egg. The disposition of the egg is not known. On my next visit on the morning of July 22, it and one nestling had disappeared. The eyes of the three survivors were partially open, appearing as slits. The young were banded later, remaining in the nest until August 2. At 6:45 P. M. August 1 (dusky), the three still occupied the nest, all facing the opening but had left when the box was visited the following morning. This indicates the nestling period was 14.5 to 15 days.

COVER DESIGN, by Elsie Herbold Froeschner. Jimson Weed, *Datura stramonium* L., is an introduced species which was originally known in this country as Jamestown weed because it first appeared in Jamestown, Virginia. It is a highly poisonous annual of the nightshade family and is one of the best sources of atropine, a drug used for dilating the pupil of the eye.

Snake Detection

HOBART M. SMITH*

No fisherman could welcome an automatic worm-trap, no housewife could behold an electric washer, with more enthusiasm than herpetologists would embrace an easy way of finding snakes. They dream of supernatural powers to divine the location of every specimen within a given—large, of course—radius, and how enormous are their catches! From time to time new reports come to their eager ears of strange ways to find the animals. Take for instance the tale of certain Indians who are supposed to be able to whistle in such a fashion as to bring all snakes within earshot wriggling out in answer to the call of their clan. And then musical instruments are said to bring snakes out of hiding, entranced by serpentine chords. These stories are, by the way, not unlike the one about eye-dropping by guinea pigs held by the tail, for snakes apparently are deaf to air-borne sound.

But, so far as anyone knows, snake-hunters continue to get their prey the hard way—by diligent and back-breaking effort, usually with poor results, and almost never with phenomenal success. In fact almost any snake-hater can be depended upon to find more snakes in the middle of Chicago than the best snake-hunter in the spot of his choice.

So it was, that is, until Charley Baker, ranchman of central Texas, came onto the scene. Baker has at last made the snake-hunter's dream come true. Merely walking about, guided by acute ears and a watchful eye, he can in two hours find more snakes—at least of some kinds—than his envious confreres have been able to amass over a period of 25 years of industrious labor.

For example, the massasauga (*Sistrurus catenatus*), better known to ranchmen as the ground rattler, was long one of the rarities of McLennan County, Texas. World-famous Strecker, veteran collector in the area; his disciples in herpetology, J. E. Johnson and Walter J. Williams of Waco, both ardent ophiologists; and E. O. Miller, long-time naturalist and school superintendent of China Springs—all have collected in and about McLennan county with a fine-toothed comb for many years. There is scarcely a stone or log they haven't turned several times in search of reptiles and amphibians. Yet in all this time, since 1920, only four massasaugas have come to hand. Ranchman Baker, on the other hand, occasionally finds as many as four in an hour or two! He also gets quantities of other rarities like blotched king snakes (*Lampropeltis calligaster*) and long-nosed snakes (*Rhinocheilus lecontei*), in addition to an abundance of common snakes. Early in his snake-hunting career he killed

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the snakes but later, with the suggestion and interest of Mr. Johnson, he began to spare their lives and now all are captured alive for use by specialists in numerous institutions far and near—not only in Texas but in Chicago and elsewhere. Accurate accounts have been kept of those captured alive but only estimates can be made of the ones killed.

In two months (July and August, 1946) Baker has found some 60 rattlesnakes of three species, and perhaps 150 harmless snakes of many kinds. These were found not in spring or fall, when any herpetologist may well find a few, but in the middle of summer with the diurnal temperature often rising to 105° F. and with collecting at its lowest possible ebb for any run-of-the-mill snake-collector who would count one snake a day a good average.

Mr. Baker's 400-acre ranch is four miles northwest of China Springs, in the picturesque hills of the North Bosque River valley, some 18 miles northwest of Waco in the heart of Texas. Here and on about 2400 acres of adjacent ranches he finds his snakes. A year ago—five years or 10 years ago—he saw few.

Why the sudden success? There is a trick to it of course, as there is to every bonanza. It is one that, regretfully, cannot well be employed widely by herpetologists. But it does work, and thereby earns distinction.

The trick is in raising turkeys! Mr. Baker has a flock of 750. He keeps them in a big pen most of the day, but at the crack of dawn or just after, and again in the late evenings, he turns the flock loose and with the aid of his wife and son guides it over hill and dale, across lots, roads and fields. After an hour or two, when the turkeys have eaten their fill of grasshoppers, and before night falls or the sun becomes too hot, he leads them back to their pen. He dares not free them longer since, with a full crop, or with excess heat or darkness, many would settle down to rest in any convenient spot and be lost. A sharp watch by all hands enables him to account for every bird after every excursion.

As the turkeys slowly stalk along, their beady eyes see and examine minutely every visible object, and any that is not readily understandable or might be interpreted suspicious by their bird brains elicits an astonished, shocked gobbling. Others gather quickly to examine the curiosity and swell the tumult, until—barring other developments—gradually they tire and move on to other excitement.

Whenever Baker hears a commotion he investigates. He never knows what he will find. The animals become incensed over all manner of objects—old bones, birds and bird nests, skunks, oddly-shaped rocks, *et cetera ad infinitum*, but often the object is a snake or other reptile; if so, Baker captures it and the hunt goes on.

This remarkable procedure has been observed not only by the author but by Mr. Johnson and Mr. Miller; all are infinitely impressed. That the

method is more effective than any other now known for such a small area at such a time of the year is unquestionable.

Two factors may contribute to the success of the turkey method. In the first place, the hunting is done at a time of day when snakes are just emerging from or just entering their night quarters. It is of interest that almost all are found in the morning. They are then cool, incapable of rapid locomotion, and are out foraging in force, avoiding the terrific heat of midday. Most herpetologists emerge somewhat later and often may be found retiring at such a time. In the second place, the drove of turkeys covers a wide area with a thoroughness humanly impossible in any other way.



The snake-hunting reader by now no doubt has already relapsed into the same old feeling of disillusionment, the goal still as inaccessible as ever. Turkey-snaking, like the whistling device, may appear as impossible in practice as psychic detection. Nevertheless it does work, when used, and it does have a moral: already a night owl, the successful snake-hunter must also be an early bird—turkey or no turkeys—and non-snake-hunters may muse that indeed for the wicked there is no rest.

The reptiles discovered by this method at Baker's ranch are as follows.

1. Earless Lizard, *Holbrookia*. Several specimens (perhaps a dozen) have been found. They are not abundant, and represent a distinct, unnamed form (now being studied by Bryce C. Brown) which has in the past been confused with *H. lacerata*.

2. Texan Horned Lizard, *Phrynosoma cornutum* (Harlan). These common lizards are found frequently.

3. Racerunners, *Cnemidophorus*. Occasional specimens are found. I have not seen the specimens and am not certain whether they represent *C. sexlineatus* or *C. g. gularis*.

4. Blue Racer, *Coluber constrictor flaviventris* (Say). Numerous specimens encountered.

5. Western Coachwhip, *Masticophis flagellum testaceus* (Say). Several were killed before Baker started capturing his reptile "finds" alive. One was captured on the morning I accompanied the turkey foray.

6. Eastern Patch-nosed Snake, *Salvadora lineata* Schmidt. A single specimen escaped before its identity was verified, but there can be little question of its identity. Johnson reports it as fairly common in spring in that area, although in 1908 Strecker (Proc. Biol. Soc. Washington, vol. 21, p. 76) had seen but two from the county.

7. Common Bull Snake, *Pituophis catenifer sayi* (Schlegel). Baker has captured two large adults, each approximately five feet in length, and a juvenile about two and one-half feet in length. Two others were observed. These and one other observed in his early youth are the only specimens Baker has ever seen on the ranch. It is now to be considered rare, although in 1908 Strecker (*op. cit.*, p. 76) reported it as "not uncommon in the prairie district between Waco and McGregor."

8. Yellow-bellied King Snake, *Lampropeltis calligaster calligaster* (Harlan). At least two specimens have been taken. Strecker calls it exceedingly rare, and records only one specimen from the county.

9. Sonoran King Snake, *Lampropeltis getulus splendida* (Baird and Girard). A beautiful adult specimen was captured on July 29, and is preserved in the China Springs school collection. Four others have been captured, and several were killed.

10. Eastern Long-nosed Snake, *Rhinocheilus lecontei tessellatus* Garman. Perhaps a dozen have been captured and killed. Rare but previously reported from several localities in the county.

11. Great Plains Ground Snake, *Sonora episcopa episcopa* (Kennicott). This small snake, whose coloration is extremely variable, is common under small stones in early spring, but is difficult to find in midsummer. Baker has captured five or six.

12. Massasauga, *Sistrurus catenatus tergeminus* (Baird and Girard). Strecker reported one from the county in 1935 (Baylor Univ. Bull., vol. 38, p. 38) and Gloyd another in 1940 (Spec. Publ. Chicago Acad. Sci., no. 4, p. 42) but no other published report is known. At least 14 have been taken alive, and possibly 20 others killed.

13. Texas Diamond-backed Rattlesnake, *Crotalus atrox* Baird and Girard. In 1935 Strecker (*loc. cit.*) says, in the discussion of this species, "All poisonous snakes are somewhat scarce." Perhaps so: at any rate they are scarcer since the turkeys went to work than before. Some 25 or more have been captured or killed. There are numerous other records for the county.

14. Prairie Rattlesnake, *Crotalis viridis viridis* (Rafinesque). After having killed many *Sistrurus* and *Crotalus atrox*, with an eye to their differences as learned by experience and with the aid of Mr. Johnson, Baker's statement that on July 5 he killed one snake agreeing perfectly with Gloyd's picture of *Crotalus v. viridis* (Spec. Publ. Chicago Acad. Sci., no. 4, pl. 22, 1940) seems authoritative. Only the rattle is now available. This, compared with 16 rattles of *Crotalus atrox* from the same locality, is distinctive chiefly in its relatively small size, less than that of any other fully-formed (*i.e.*, whose segments do not taper distally) rattle available. The one in question has eleven segments, all of equal width, yet measures only 17 mm. in width. The only rattle of *C. atrox* which does not taper distally measures 19 mm. in width and is considerably larger. In view of the fact that the species is to be expected in this county (recorded even slightly farther east in Dallas County to the north, and in Travis County to the south), the evidence is acceptable as a record of occurrence of *C. v. viridis* in McLennan County. It has not elsewhere been reported from the county.

15. Ornate Box Turtle, *Terrapene ornata* (Agassiz). Box turtles have been found by the dozen, but the species (whether the Ornate or Three-toed) is uncertain. It is possible that both forms have been taken, and certain that at least most specimens represent *T. ornata*.

Amphibians are conspicuously absent from the preceding list. They are seldom found. The only species encountered, according to Mr. Baker, are leopard frogs (*Rana pipiens berlandieri* Baird) and toads. The species of the latter is uncertain.



The nearly complete absence of the various burrowing, arboreal, and semiaquatic species, recorded from McLennan County by Strecker, is easily understood in view of the nature of the terrain and manner of exploration by the turkeys. Skinks (*Eumeces*, *Leiopisma*) and glass-snake lizards (*Ophisaurus*) are perhaps too alert and secretive to be discovered and cornered by the turkeys. Less easily comprehended is the absence of any of the rat snakes (*Elaphe*). On the other hand, it is surprising to observe so many largely nocturnal species in this list: 7 of the 11 snakes are regarded as nocturnal. All of the remaining 4 are strictly diurnal. It is apparent that these 7 species (of the genera *Sistrurus*, *Crotalus*, *Rhinocheilus*, *Lampropeltis*, *Sonora*) should be regarded as crepuscular, at least in part, as well as nocturnal. It should be of great interest to record the hour of capture and light intensity at the time of capture of all specimens, in order to determine whether the apparently crepuscular species are more frequently encountered in the hours of diminished light intensity.

Museum Activities

Field Work

Dr. H. K. Gloyd and Thurston I. Wright spent the first two weeks of October in South Dakota observing, photographing and collecting rattlesnakes. They were guests of A. M. Jackley of the South Dakota Department of Agriculture. Mr. Jackley is in charge of the state's campaign for the control of rattlesnakes, considered a serious menace to live stock and human life in that area. His vast fund of knowledge of the life cycle and behavior of these snakes made possible some exceedingly interesting observations.

The party visited snake dens in several localities in central and western South Dakota, collecting approximately a hundred rattlesnakes and making motion pictures, until low temperatures with rain and snow made such field work impossible. The large catch of rattlesnakes, and a small number of non-poisonous species, was made principally on one day. Most of the rattlesnakes were shipped to the Lincoln Park Zoölogical Garden for exhibition and experimentation.

Among the points of special interest were visits to Thunder Butte, famous for its snake den since the 1870's; to dens dug out by the badger, one of the snakes' chief natural enemies; to a prairie dog town, where snakes were basking in the sun at the entrances of the burrows; and to dens at which Mr. Jackley's specially designed snake traps were in operation. These traps have been described in an article by Dr. Gloyd entitled "The Problem of Too Many Snakes," *Chicago Naturalist*, volume 7, 1944, number 4, pages 87-97. It is hoped that a future visit, under better weather conditions, may make it possible to complete the motion picture film on these snakes as they congregate at their hibernating dens with the approach of winter.



Dr. Ball to University of Kansas City

Dr. John Rice Ball, a life member of the Academy and for many years a member of the Board of Scientific Governors and Honorary Curator of Geology and Paleontology, has recently accepted a position as Visiting Professor of Geology and Geography at the University of Kansas City. At the time of his retirement last June, he was Professor of Geology at Northwestern University.

Dr. Ball has had a long-standing interest in the Academy and has served the museum in a countless number of ways. He has devoted many hours to the arrangement of the exhibits of invertebrate fossils, the care of the reference collections, and the identification of specimens in his field of specialization. He has contributed several articles and book reviews to *The Chicago Naturalist* and is co-author of *Special Publication No. 7*, "Catalog of the Egan Collection of Silurian Invertebrate Fossils at the Chicago Academy of Sciences." For the past several years he has also served as a member of the Scientific Governors' Committee on Publications. The director and members of the museum staff appreciate his friendly counsel and gracious assistance on so many occasions. His resignation has been accepted with sincere regret.

Fall Lecture Series

An excellent group of speakers has been secured for the Fall Lecture Series on Sunday afternoons, November 3 to December 22, inclusive.

This year each lecture will be presented twice, as usual. The first, at 2:30, is primarily for the general public, and no seats are reserved. The second, at 4:00, is for members. All seats will be reserved until 4:00, when those not claimed by members will be open to others. Each member will be allowed two seats and the membership card will serve for admittance. We trust that this arrangement will be less confusing and more satisfactory than those of the past.

The full program for this series is as follows:

Nov. 3: **Flowers in Action** (natural color motion pictures of growing flowers, weed killing experiments, insectivorous plants), John Nash Ott, Winnetka.

Nov. 10: **Plant Hunting in El Salvador** (Kodachrome slides), Dr. Margery C. Carlson, Northwestern University.

Nov. 17: **Chugach Vacation; Wildlife on the Kenai, Alaska** (natural color motion pictures), William P. MacLean, J. Sterling Morton Schools.

Nov. 24: **Pathways Along the Pacific** (natural color motion pictures), Ray Eggersted, Elgin.

Dec. 1: **Trails of Chicagoland** (color motion pictures), Auguste Mathieu, Chicago.

Dec. 8: **Guatemala** (natural color motion pictures), Albert Tate Johannsen and Anna Ormsby Johannsen; Crete, Illinois.

Dec. 15: **Summer Homing and Roaming in the Great North Woods** (natural color motion pictures), Sam Campbell, "Philosopher of the Forest," through the courtesy of the Chicago and North Western Railway Company.

Dec. 22: **Scenic Beauties—Majestic Peaks of the Cascade Range and Glorious Gardens of the South** (Kodachrome slides), Dr. Louis J. Tint, Chicago.

Midwest Museums Conference

The nineteenth annual meeting of the Midwest Museums Conference of the American Association of Museums was held in Chicago, October 24 to 26. The local museums were hosts to the group and an interesting program was arranged by a committee under the chairmanship of Colonel Clifford C. Gregg, director of the Chicago Natural History Museum.

The sessions were arranged so that each of the following Chicago museums was visited: Art Institute, Chicago Historical Society, Academy, Museum of Science and Industry, Oriental Institute, Shedd Aquarium, Adler Planetarium, and Chicago Natural History Museum.

On Thursday evening, October 24, the conference had an informal gathering at the Academy. Following a general social hour, a movie about Chicago museums was shown in the auditorium.

Kennicott Club

Dr. Eliot C. Williams, Jr., assistant to the director, was elected secretary-treasurer of the Kennicott Club at the October meeting. Other officers elected were Dr. Alfred Emerson, president; and John Millar, vice-president.

The Kennicott Club, which holds half of its meetings at the Academy and half at the Chicago Natural History Museum, is an organization of local naturalists particularly interested in field problems.

Academy Receives Grant from Community Trust

The Academy received a grant of \$1,000 from the Chicago Mechanics Institute Fund through The Chicago Community Trust for use in its educational program during the year 1947. It is planned to use this fund for a special program of activity for young people during the summer months. Definite plans will be announced in the spring.

Weeds and Insects Studied by Schools

An exhibit of over 200 common weeds of the Chicago Region was again on display at the Academy during the month of October. This excellent collection, from the herbarium of Anna Pedersen Kummer, Honorary Curator of Botany at the Academy and teacher of botany at Waller High School, continues to be in demand by schools in which the curriculum includes the study of weeds and insects.

Many classes visited the museum for the specific purpose of studying the special exhibit of weeds, and the permanent exhibits of insects. A lecture on insects, illustrated with color motion pictures from the Academy's film library, was given by Dr. Williams to fifty-three classes, totalling over 1600 students, during a four-week period. Many other groups came to study the exhibits under the guidance of their teachers.

Herpetologists Club

At its October meeting, the Amateur Herpetologists Club, organized under the sponsorship of the Academy in 1938, adopted a new constitution and a change of name. It will now be called The Chicago Herpetologists Club. Meetings are held regularly in the preparations laboratory of the museum on the evening of the second Tuesday of each month.

Recent Visitors

Representatives of other museums who have visited the Academy this fall include W. Stephen Thomas, director of the Rochester Museum of Arts and Sciences; Miss Lucy W. Clausen of the department of education, American Museum of Natural History, New York; Dr. Robert C. Miller, director of the California Academy of Sciences, San Francisco; and Mr. and Mrs. Lewis H. Babbitt of the Worcester Natural History Society, Worcester, Mass.

Academy Appoints Scientific Associates

Dr. Max E. Britton, Dr. William E. Powers, and Dr. Albert Wolfson of the Northwestern University departments of botany, geography, and zoology, respectively, have been appointed Associates of the Academy. Associates are semi-official members of the museum staff whose scientific investigations require the use of museum materials and whose specialized knowledge, in their capacity as consultants, can be applied to museum problems of a technical nature. Appointments are made annually by the President of the Academy upon the recommendation of the director of the museum and the approval of the Board of Scientific Governors.

An Additional Bequest from the Martin Estate

An additional sum of one thousand dollars has been received from the estate of the late Isabelle Hollister Martin, making a total bequest of two thousand dollars to the Academy, in memory of Mrs. Martin's father, John Hamilcar Hollister, M. D.

Staff Notes

Evelyn Wade, secretary to the director, resigned in August. Her husband, C.P.O. Claude Wade, U. S. N., formerly of Navy Pier has been transferred to Pensacola, Florida.

Mrs. Wade has been succeeded by Jacqueline D. Kaucher.

Fred H. Jaeger, recently of the Naval Air Corps, has joined the staff as an assistant in the preparations laboratory.

Edward R. Ford, Honorary Curator of Ornithology, who now resides at Newaygo, Michigan, visited the Academy recently. With the assistance of Philip A. DuMont of the Fish and Wildlife Service, Mr. Ford is preparing a revised edition of "Birds of the Chicago Region," by Ford, Sanborn and Coursen, 1934. Publication of the new edition is planned for early spring, 1947.

The Naturalist's Book Shelf

BRAZIL (ORCHID OF THE TROPICS)

By Mulford B. and Racine Sarasy Foster

The Jaques Cattell Press, Lancaster, Pa., 1945, xi, 314 pages, plates (4 in color), drawings, index. \$3.50.

In the spring of 1939 and again in 1940, Mulford and Racine Foster went to Brazil to collect botanical specimens. The epiphytic bromeliads—members of the pineapple family which grow upon other plants without deriving nourishment therefrom—were the plants which the Fosters particularly wished to obtain. This book is the story of their work. Popular opinion notwithstanding, such expeditions are not one long exciting, romantic adventure; rather, there is work—lots of it—together with numerous discomforts, hardships, delays, and disappointments.

On their two trips the Fosters traveled over 12,000 miles. Among the thousands of plant specimens they collected many new species were found. In one genus alone 21 new species were discovered—a high score in itself—but even more impressive when compared to the 75 new plants added to the genus by other botanists in the 150 years prior to the Fosters' expeditions.

Most of the specimens were pressed for herbarium material, but several hundred viable plants were brought back too. These now flourish in the Fosters' tropical garden in Florida, living souvenirs of their Brazilian adventures. Although other plants such as orchids, cacti, and unusual ferns were included in their collections, the bromeliads received the most attention.

Besides the actual work of collecting and pressing specimens, the Fosters made photographs and colored drawings in order to insure the greatest possible accuracy in identification. Accordingly, the book contains many photographs in black and white and four excellent color plates reproduced from Kodachromes by the Fosters. Mr. Foster has contributed further illustrations with numerous ap-

pealing pen sketches.

In format and makeup the book is disappointing. Editorial and proof work have been regrettably hasty and careless. Typographical errors are frequent, the photographic retouching unnecessarily obvious. In the copy received for review two different sets of photographic plates (8 pages in all) were inserted upside down.

Kathryn J. Stephenson.

ROCKS AND RIVERS OF AMERICA

By Ellis W. Shuler

The Jaques Cattell Press, Lancaster, Penn., 1945, xvi, 300 pages, index, 2 appendices, 105 halftones. Cloth, \$4.00.

Geologists today are seeking to express their thoughts in striking enough form to arrest and to hold the attention of the casual reader. In the past geologists themselves have been the ardent readers of geological literature and a fact, no matter how expressed, would satisfy them if in accord with their personal convictions.

Modern writers, however, have sought to make others than professional geologists respond to the winsome invitations of nature, to recognize and to appreciate her charms. In this endeavor, Professor Ellis W. Shuler has succeeded in marked degree. He is speaking to the reader much in the manner and style with which he and countless other teachers address a classroom full of college students. But there is more in his presentation. He is reminding his readers of the messages from nature that great minds of all ages have received and interpreted. He is introducing them to Louis Agassiz, Leonardo da Vinci, to Palissy, to Charles Lyell, to Powell, and other brilliant minds whose ability and charm oftentimes have been known only by the professional followers of science.

He does more! He leads the reader into the days of the past when things were different. To consider things as

they then were does not fill the mind with discontent about things as they now are, but rather impresses one with delightful wonder and awe that matter, animate and inanimate, could be so wonderful. Other lands and other beings existed, and to all there was given the same great pleasure and achievement of existence as prevails today. Geologists perhaps may feel an unspoken rebuke in reading the printed words of Shuler. They have been almost too unconsciously selfish in being nearly the sole possessors of truths which are free for all.

The book may be read in a few evenings but when it is finished the reader will have achieved as much or more than the traveling vacationist, with his records of mileages, gasoline and places visited. He will have journeyed far and near through America, from Niagara to the Grand Canyon, from Mount Rainier to the Great Smokies. He will have looked with sympathy and insight upon the efforts of toilers in the wheat-fields of the West and upon those of the

Appalachian ridges. But mostly he will have reveled in the new powers of interpretation which the reading of the book will give him. He will have analyzed the messages a handful of sand has for him. He will have looked into the past of a river in a Grand Canyon or in a Royal Gorge. He will have read the message of the ages in the roar of Niagara Falls, or in the dash of waters over the brink of Yellowstone or Yosemite. He will have viewed mountain range and butte, a Garden of the Gods, and a glacial erratic—with full appreciation of days before these things appeared, and of the days when they came into being. He will find in the book over one hundred pleasing half-tone photographs of telling examples of all these accomplishments. But in these instances, instead of embellishing a postal card picture of a scenic effect, they will have served to illustrate the author's skillful and competent phrasing of how it all came to be. Nature's handwork, dynamic Geology!

John R. Ball

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